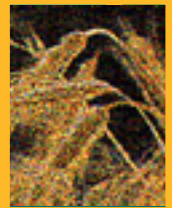


ARCHIVE



NZ SAFETY  
LIMITED

GUIDELINES  
ON PERSONAL  
PROTECTION  
FOR  
AGRICHEMICAL  
USERS



**Important Note:**

All the publications in the Publications Archive contain the best guidance available at the time of publishing. However, you should consider the effect of any changes to the law since then. You should also check that the Standards referred to are still current.

# ARCHIVE

## GUIDELINES ON RESPIRATORY PROTECTION AND FILTER REPLACEMENT

### 1 BACKGROUND INFORMATION

The correct use and care of respiratory protective devices is an important consideration for all agrichemical users. The effective life of the purifying filter on a respirator depends on the conditions allied to its use. All agrichemical users should understand the factors associated with adequate respiratory protection, including selection, proper use techniques and filter replacement. The following paragraphs provides some guidance but for more detailed information consult the New Zealand Standard AS/NZS 1715-1994 *Selection Use and Maintenance of Respiratory Protective Devices* or *A Guide to Respiratory Protection*, (published by the Occupational Safety and Health Service with support of NZ Safety Ltd. 1999.)

Amongst other provisions, the Health and Safety in Employment (HSE) Act 1992 requires all employers to assess and identify significant hazards and develop systems to manage them in a way that employees and others will not be harmed. Elimination or isolation of hazards is the required method. If this is not practicable, then minimization of the likelihood that the hazard will cause harm by adoption of protection measures can be taken. Every employer must ensure that employees are trained in the safe use of protective equipment.

### 2 TYPES OF RESPIRATORY HAZARDS

Respirators are designed to protect against one or more of the following types of air contaminants:

- Particles of dust, or mist.
- Gases or vapours.
- Lack of oxygen.

### Dusts and mists

Dusts are small solid particles dispersed in the air, mists are fine droplets of liquids in the air which may contain particles or dissolved substances.

### Gases and vapours

These are the gaseous state of a substance and are in three broad classes:

- Acid gases such as hydrogen chloride.
- Alkaline gases such as ammonia.
- Organic vapours such as solvents.

Note: Fumes which are generated by heat in welding or molten metal process do not occur during the normal use of agrichemicals.

### Lack of oxygen

This situation is unlikely to be encountered in the normal agricultural/horticultural scene, however it should always be expected particularly in confined spaces such as grain silos, where carbon dioxide produced from the decomposition of organic matter displaces oxygen.

### Agrichemical hazards

During the use of agrichemicals, a variety of hazards will be encountered depending on the formulation of the compound and the method of application. This aspect is discussed in greater detail in a later section.

### 3 TYPES OF RESPIRATORS

There are three main categories of respirators;

(a) Air purifying respirators, i.e. these draw air through a purifying filter which can be one of three types:

- Particulate filter for dusts, mists and fumes. Class P1 low efficiency, class P2

medium efficiency, and class P3 high efficiency. For maximum protection, the Class P3 filter in a full face piece should be used for agrichemicals.

- Gas filters for gases and vapours. The size of the filter, or adsorption capacity, will determine the length of time that it can be used. Class 1 low capacity, Class 2 medium and Class 3 high.
- Combination filters which are a combination of a particulate filter and a gas filter.

(b) Supplied air respirators: these are fed from a clean air supply outside the contaminated area.

(c) Self-contained breathing apparatus (SCBA): these use a clean air supply carried by the wearer.

In each of the above cases, there are various forms of face piece available such as:

- Half face piece; covers the nose, mouth, and chin and will have either single or double filters fitted, may have replaceable filters or the entire respirator may be disposable.
- Full face piece: covers the whole face and will have either single or double filters fitted. (NB SCBA requires full face piece only.)
- Helmet or hood: covers the head. Usually supplied with air from an external source such as a blower/fan unit drawing air through a filter system.

In each of the above cases, there are systems available where a battery-operated motor unit can be fitted to draw air through a filter. These systems are known as Powered Air Purifying Respirators (PAPR).

#### 4 ADVICE TO AGRICHEMICAL USERS

The most common respirators used with agrichemicals will either be the air purifying filter type suitable for dust and mist, or the gas filter type, suitable for organic vapours and volatile pesticides, or a combination of both.

Users need to be satisfied that they are wearing the correct protection at all times by making a full assessment of the circumstances under which the chemical is being used.

Where chemicals are being sprayed, the type of spray unit will have an influence on the selection of respiratory protection. High-volume, high-pressure units will cause more drift into the operator's breathing zone than low-volume low-pressure models. Wind will also cause increased risk of drift into the breathing zone.

Powered respirators are often preferred when the user is required to wear the apparatus in hot, humid conditions because of the cooling effect of the moving air, and the absence of breathing resistance and fatigue.

Note: air purifying filter respirators are not suitable for use where there is a lack of oxygen.

#### Protection when handling concentrates

Operators should be aware that, when handling concentrates, extra care is required to ensure adequate protection both from a respiratory and personal protection point of view. Chemicals in a concentrated form are far more hazardous than the diluted product.

When mixing concentrates, the main hazard is splashes to the skin or eye. A face shield or goggles will provide eye protection from splashes. Respiratory protection will need to be of a high standard, especially if the product has a high vapour pressure, i.e. it is smelly or gives off vapours.

Under these conditions, it will be necessary to wear a respirator during mixing. For maximum protection, this will have to be compatible with the eye protection.

## Types of agrichemicals

From the above information, it will be evident that the selection of the appropriate respiratory protection is closely linked to the type of chemical being used and the conditions under which it is used.

Agrichemicals can be classed in a number of different chemical groups, each with its particular hazard generally, based on toxicity of the active ingredient such as the following;

- Organophosphates
- Carbamates
- Synthetic pyrethroid
- Herbicides
- Fungicides
- Fumigants
- Solvents
- Petroleum products.

Each of these chemical groups may be available in a variety of physical formulations such as (list is not complete):

- Wettable powders
- Water-soluble concentrate
- Emulsifiable concentrate
- Soluble concentrate
- Suspension concentrate
- Water dispersible granules
- Granular bait
- Fumigant.

## 5 SELECTION OF RESPIRATORS

When selecting the right respirator for the job, five factors need to be considered:

- (a) The nature of the contaminant, such as toxicity and physical form.
- (b) Likely average concentration in the air being breathed by the operator.
- (c) The task that is being carried out which may affect the breathing rate.
- (d) The length of time the task will take and the location of the task.
- (e) The operator's facial fit and comfort in use.

Each of these factors must be fully assessed prior to commencing the task to enable the correct selection to be made. Respirators are usually available in a selection of sizes to fit different face profiles. It is important that the correct-sized facepiece is selected.

## 6 FILTER SELECTION

The appropriate protection for each chemical can be assessed according to its physical state or formulation. The type of work and spray or application equipment being used will also be an important factor. The type of protection required could be influenced by combined hazards, and these will generally be stated on the label. The following guidelines may be helpful:

- (a) Most sprayed agrichemicals consist of wettable powders, dusts and other formulations which form mists. A particulate filter suitable for toxic dusts and mists is the most appropriate filter for these products.
- (b) For those products which present the greatest risk by the release of harmful vapour, or deadly or dangerous poisons, a combination filter consisting of a particulate filter fitted over a gas filter may be the best option. This option may be appropriate with other chemicals also.

(c) Particulate filters act as a barrier to the droplets and solid particles in the spray, permitting clean air to pass through. Gradually the filter will become clogged, and breathing resistance increases to a point where it causes the wearer discomfort. At this time, the filter should be replaced.

(d) For those sprays and chemicals which contain organic solvents as a carrier liquid, or contain other products with a high vapour pressure, i.e. are strong smelling or volatile, gas filters are required. Gas filters contain a bed of charcoal or other agents that adsorb or reacts with the chemical, retaining the gas or vapour and allowing clean air to pass through. Gas filters need to be replaced as the sorbent material becomes saturated. The following points need to be considered in respect to the use of gas filters:

- (i) Manufacturers and distributors of respirators can provide information and advice about approved filters. Different gas filters are required for each different group of chemicals, i.e. filters that protect against organic vapours will be no good for ammonia. Only use filters that are approved for use against the specific product.
- (ii) Some chemicals have poor warning properties, i.e. they have very little odour. Protection for these products may involve the use of supplied air devices.
- (iii) Air purifying respirators must never be used in conditions that are immediately dangerous to life if the respirator should come off or fail e.g. fumigation using methyl bromide. Since air purifying respirators only provide protection for the

inhalation of contaminants, additional protective equipment may be necessary to protect the eyes from irritation and the skin from absorption of the chemical.

## 7 SERVICE LIFE OF GAS/VAPOUR FILTERS

The service life of a gas filter, or how long it is going to continue to provide protection, depends on a number of factors such as;

- (a) Physical properties of the chemical/pesticide.
- (b) The type of solvent or carrier in which it is delivered.
- (c) The airborne concentrations of the chemical/pesticide.
- (d) Conditions of use i.e. type of spray system.
- (e) Capacity and efficiency of the filter.
- (f) Worker breathing rates i.e. light or heavy work.
- (g) Humidity, temperature, and how well the respirator fits.

The most important of these are the physical properties and concentration of contaminant, the air flow rate, and humidity. The working conditions and the type of equipment used may also be significant. Issues such as winter versus summer application, sitting on a tractor or walking, hand spraying as against air blast equipment, need to be assessed. In general, a heavy concentration of contaminant and heavy breathing rates will shorten the life of a filter.

### Developing a service life policy

By individually evaluating all the factors involved with respirator selection as set out in this section, employers, contractors and users should be able to arrive at a policy on service life for gas/vapour filters. The complicated relationship between all these factors makes it almost impossible to establish general advice

on service life to cover all situations. Therefore, the policy should state clearly the change schedules based on the best case scenario for each application, with an allowance built in for safety. This policy will include consideration of the following:

- (i) If particulate filters are independently fitted in combination with gas filters, their replacement should be indicated by breathing resistance, or alternatively replaced daily. They are not costly and replacing them frequently may lead to longer gas filter life when used in combination.
- (ii) The time it takes for the gas or vapour to breakthrough the filter is known as the breakthrough time. Detecting the breakthrough time is the critical issue in estimating service life. At this point the wearer may detect odour or taste, but there are a number of reasons why this should not be relied on as the sole method of detection. Many people do not have a good sense of smell or taste; the sense may be temporarily masked by a cold; and other smells may mask the odour of the contaminant. Despite these limitations, detection of odour and taste is still a useful guide to be used in conjunction with other considerations.
- (iii) Other considerations to be taken account of in developing a filter replacement policy, will include: the weather conditions at the time of use, particularly humidity (is it high or low?) Is the wind blowing, forcing spray drift into the operators breathing zone? The type of chemical being protected against: does it give off harmful vapours? How is it being used (high- or low-volume sprayer) and what is the work rate of the operator? Is it a manual or sedentary task? For each separate application, a clear policy should be developed on how often gas filters need to be replaced with directions on correct disposal of used filters. All gas filters must be discarded no longer than six months after opening, regardless of the number of uses.
- (iv) The replacement schedule should be established at an easy-to-recall time interval such as beginning of each week, before each specific task, every two days, etc. The detection of breakthrough by taste or smell at any time should result in immediate replacement.
- (v) All gas filters must be stored, while not in use, in a sealed (airtight) container, preferably away from stored chemicals, to prevent the filter accumulating contaminants. For maximum efficiency and safety, it is essential that respirators are properly maintained and cleaned in accordance with the manufacturer's instructions.
- (vi) The distributors of respiratory protective devices and safety equipment have expertise available to assist operators to make decisions on service life policies and other user queries. These experts should be consulted if there is any doubt.
- (vii) Included with these guidelines are three charts. Charts one and two give simplified guidance on respirator selection and filter service life. These charts should be read in conjunction with the above information.

## CHART ONE

### HOW TO SELECT SUITABLE RESPIRATORY PROTECTION WHEN USING AGRICHEMICALS

#### READ THE LABEL

To identify the type of ingredient, formulation and recommended safety advice

Does the product contain:

- Organophosphate
- Carbamate
- Solvent
- Fumigant\*
- Other deadly or dangerous poison

No

For other chemicals: will the contaminant form a particulate?

- i.e.
- Wettable powder
  - Suspension concentrate
  - Emulsifiable concentrate
  - Water-dispersible granules
  - Granular bait

No

- Does the method of use potentially cause chemical drift into the breathing zone of the operator? or
- Will the weather conditions cause chemical drift into the breathing zone of the operator?

No

SELECT:

- Half face piece or better; with particulate filter suitable for toxic dusts and mists; or
- Combined particulate and gas filter

If unclear consider maximum protection and seek further advice

SELECT:

- Full face piece or
  - Air supplied hood/helmet or
  - Powered air purifying device
- All fitted with a combined particulate gas filter (agricheMical)

\* May need Self-Contained Breathing Apparatus

Yes

Yes

SELECT:

- Half face piece or better; with,
- Particulate filter suitable for toxic dusts and mists; or
- Combined particulate and gas filter (organic vapour)

Yes Note: Mixing will require higher protection)

NOTE: The service life of a gas filter will relate to its size. The larger the filter, the longer the possible service life.

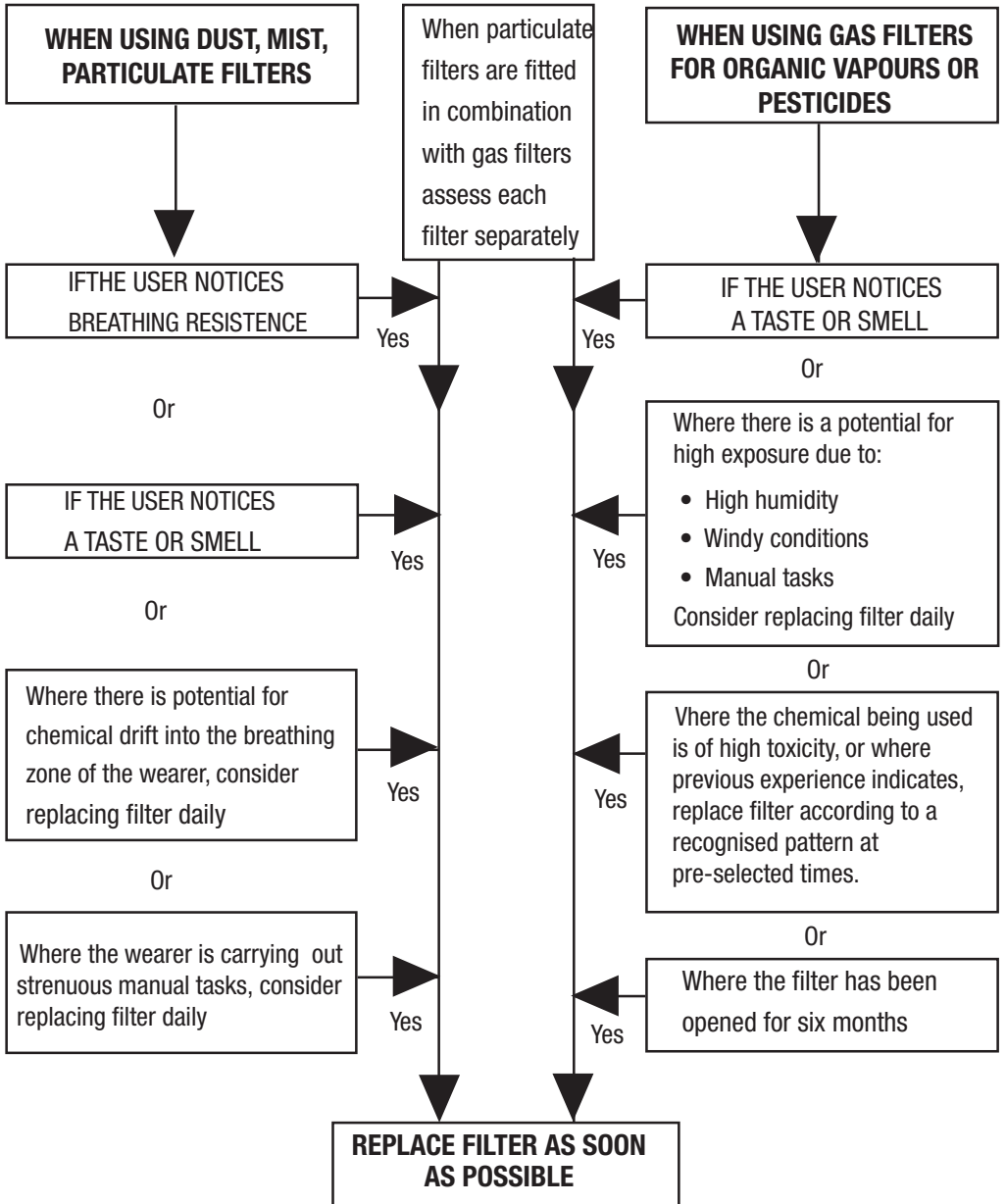
IMPORTANT: Refer to chart two for information on replacement times for filter.

**CAUTION:** the chart provides guidance only. If in doubt, take expert advice.

## CHART TWO

(Chart one gives guidance on the selection of suitable filters)

### FILTER REPLACEMENT: HOW TO ESTIMATE THE LIKELY SERVICE LIFE OF A FILTER WHEN USING AGRICHEMICALS



NB: All gas filters must be stored in a sealed airtight bag to prevent the filter absorbing contaminants.

# ARCHIVE

## GUIDE TO MINIMUM PROTECTIVE CLOTHING FOR USERS OF AGRICHEMICALS

### 1 INTRODUCTION

The selection and use of protective clothing for users of agrichemicals requires sensible consideration of a number of issues which have been included in the flow chart for easy reference. Chart three provides guidance on the selection of protective clothing when using agrichemicals. This should be used in conjunction with the following notes:

- (a) Always wear gloves and boots inside the sleeves and legs of protective clothing.
- (b) Always wear the recommended minimum protective clothing during mixing and use of agrichemicals.
- (c) Where an agrichemical is a mixture of different substances, always wear the protective clothing applicable to the most hazardous component.
- (a) Agrichemicals in solid form such as granules or baits may not require a high level of protection unless dust is a problem.

### 2 GENERAL

Selecting the most appropriate protective clothing for any task will always involve a degree of personal choice and discretion. As with respiratory protection, there are a number of issues to be assessed before deciding on what is best. The following questions will assist:

- (i) What is the type of chemical? What form is it in and what are the health effects of exposure?
- (ii) What type of protective clothing is currently being used? Does this seem adequate or not?

- (iii) What is the preference of the user?
- (iv) Will the protective clothing be used often or infrequently?
- (v) How much chemical contact will there be? Is there a potential for a spill or leak or high chemical contact in the task?
- (vii) What are the likely decontamination procedures?

### 3. PERMEATION, DECONTAMINATION AND DEGRADATION

The most important issues in respect to the suitability and safe use of protective clothing are the rate at which chemicals pass through — permeation — and cleaning after use/ decontamination.

- (i) Permeation rates are generally available for most safety products, and charts showing this are usually obtainable from safety equipment suppliers. Because agrichemicals often contain a mixture of substances, choosing the correct combination may be difficult. If there is any doubt, use the equipment that provides the maximum protection. Penetration of liquid and degradation of the clothing are signs that it is not suitable for protection against the chemical or for that application.
- (ii) Decontamination of clothing and equipment after use with agrichemicals is another difficult area to provide firm advice on. In general, an acid product may be washed with a soda (alkaline) solution and vice versa. Organic solvents or petroleum-based products can usually be washed off using a common

detergent. Copious quantities of water will also assist in removing surface contamination. Absorbent fabrics such as cotton overalls can be washed in hot soapy water using usual methods but it is not recommended that this be done with household washing. The use of 'limited use' or disposable-type suits is an alternative to decontamination and is now more widely accepted.

(iii) Degradation of the material used for protective clothing may take place over time after contact with chemicals. Usually when this occurs, the fabric will become brittle or hard, and this should be a good indicator that replacement is necessary.

**CHART THREE**

**HOW TO SELECT SUITABLE PROTECTIVE CLOTHING FOR THE SAFE HANDLING OF AGRICHEMICALS**

**NOTE:** always wear a minimum of face/eye protection and gloves when mixing concentrates into spraying strength mixture

**Does the product contain:**

- Organophosphates
- Carbamates
- Hydrocarbon solvents
- Other deadly or dangerous poisons

Yes

Does the method of use, or weather conditions, potentially cause spray to drift into the operator's breathing or body zone?

Yes

- Wear full impervious chemical suit with hood (made from PVC, CPF or poly laminated Tyvek or similar product)
- Gauntlet gloves (made from PVC, neoprene, or similar product)
- PVC or rubber gumboots
- Face/eye protection
- Respirator (See chart one)

No

For other chemicals such as:

- Herbicides
- Wettable powders
- Suspension concentrate
- Emulsifiable concentrate
- Grains and baits

Yes

Is the application method directional or is spray drift to the operator's breathing or body zone either minimal or very low?

No

No

Yes

- Wear cotton overalls (except where the operator is likely to brush against plants - wear PVC overtrousers)
- Hat or head cover
- Gauntlet gloves (PVC, neoprene or similar product)
- Face/eye protection
- Respirator (see chart one)
- Suitable footwear

**CAUTION:** This chart gives guidelines only. If in doubt, seek expert advice or wear maximum protection.